# Vaporizer 19 and 19.1 Service Procedures

## INSTALLATION PROCEDURE

1. Turn the System Power switch to STANDBY. Close all cylinder valves and disconnect all pipeline hoses.

2. Determine the mounting position for the vaporizer. Earlier machines have agent labels above the vaporizer mounts; later machines have arrow labels.

   If you are installing a Sevoflurane vaporizer on an earlier machine, install an arrow label (P/N 4112055) over the existing label.

3. If applicable, remove the short circuit block from the vaporizer mount.

4. Place the O-rings (P/N 2121929) over the inlet and outlet ports at the rear of the vaporizer.

5. Carefully attach the vaporizer to the mount with two 4 x 30 metric screws (P/N HW01072) and tighten the screws. See Figure 1.

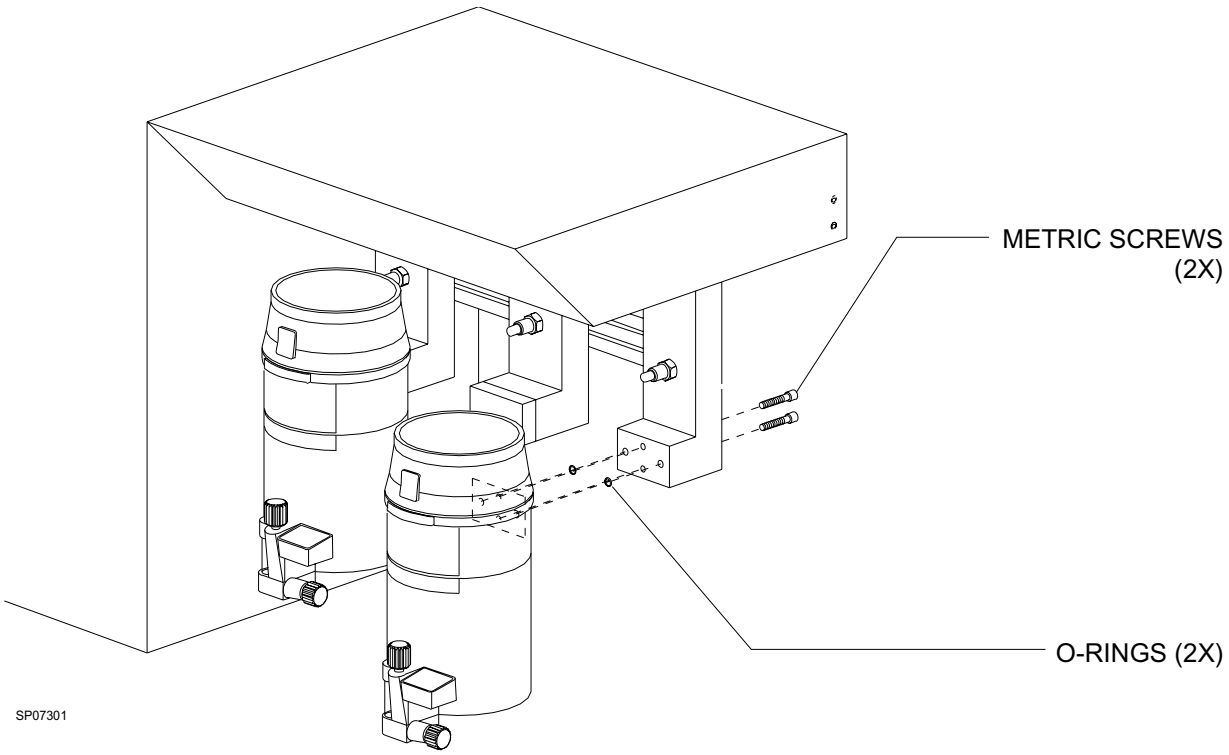


**Figure 1: VAPORIZER MOUNTING ARRANGEMENT (FUNNEL FILL TYPE ILLUSTRATED)**

## INSTALLATION PROCEDURE (continued)

6. Perform the following test on the vaporizer interlock mechanism and make any adjustments that are needed. Figure 2 shows the adjusting screw locations, viewed from the rear.

NOTE:
If the machine has a TEC 6 Desflurane vaporizer installed, use the adjustment procedure given in Service Procedure SP00091 instead of the procedure that follows.

6.1 Turn the center vaporizer handwheel ON. The left and the right vaporizer handwheels should be locked in their Zero position. If the left or right vaporizer does not lock, tighten the corresponding center set screw until the handwheel locks properly.

6.2 Turn the center vaporizer OFF and turn the left vaporizer ON. The center and the right vaporizer handwheels should be locked in their Zero position. If the right vaporizer does not lock, loosen the locking nut on the right set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

NOTE:
Do not over-tighten the set screws. Each vaporizer handwheel must turn easily while the other vaporizers are locked.

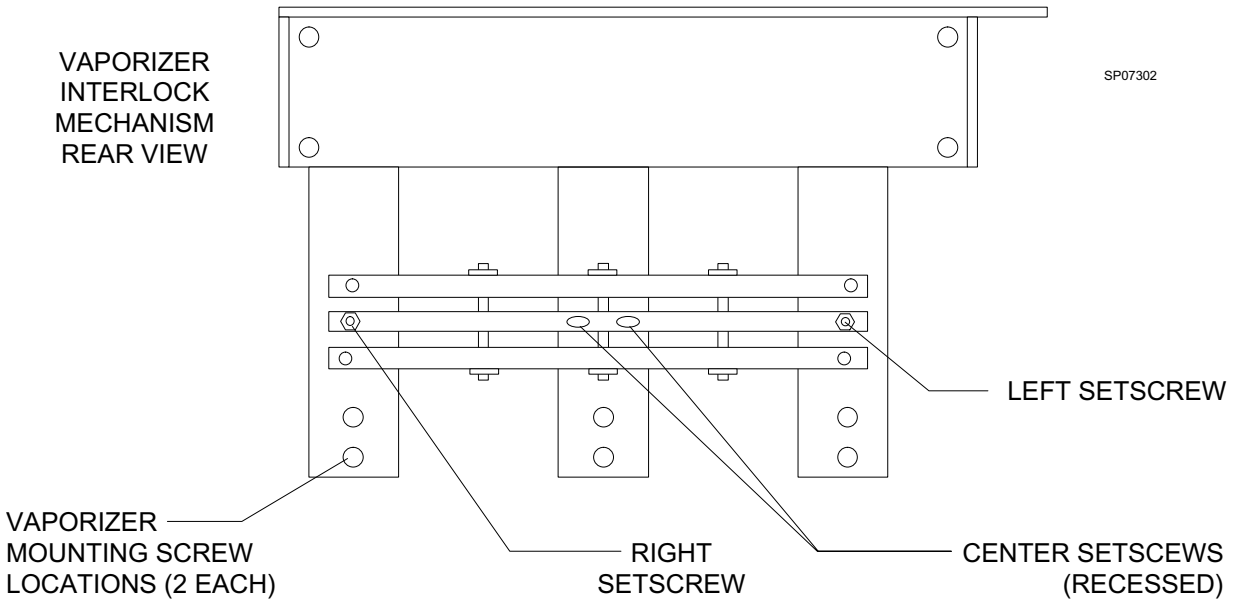


**Figure 2: VAPORIZER INTERLOCK ADJUSTMENT**

## INSTALLATION PROCEDURE (continued)

6.3 Turn the left vaporizer OFF and turn the right vaporizer ON. The center and the left vaporizer handwheels should be locked in their Zero position. If the left vaporizer does not lock, loosen the locking nut on the left set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

6.4 When the interlock adjustment procedure is completed, ensure that all vaporizer handwheels are set to their Zero or OFF position.

6.5 Ensure that all vaporizer inlet and drain valves are completely closed.

7. Perform the following fresh gas leak test:

7.1 Remove the 15 mm connector from the FRESHGAS OUTLET.

7.2 Is the common gas outlet assembly in good condition? ___ (Y)

7.3 Connect a digital pressure manometer and Fresh Gas Leak Test Device to the freshgas outlet.

7.4 Apply 50 cm $H_2O$ of pressure to the system.

7.5 After thirty (30) seconds, what is the pressure on the manometer? ___ (>40 cm $H_2O$)

7.6 Turn on the left mounted vaporizer to the first graduated marking.

7.7 Apply 50 cm $H_2O$ of pressure to the system.

7.8 After thirty (30) seconds, what is the pressure on the manometer? ___ (>40 cm $H_2O$)

7.9 Turn off the vaporizer.

7.10 Remove the test equipment from the Fresh Gas Outlet.

7.11 Turn the System Power switch to ON.

7.12 Open the $O_2$ flow control valve to 5 l/min., purge the system for 5 seconds, then close the $O_2$ flow control valve.

7.13 Turn the System Power switch to STANDBY.

7.14 Turn on the center mounted vaporizer to the first graduated marking, repeat Steps 7.7 thru 7.13 ___ (>40 cm $H_2O$)

7.15 Turn on the right mounted vaporizer to the first graduated marking, repeat Steps 7.7 thru 7.13 ___ (>40 cm $H_2O$)

7.16 Remove the manometer and Fresh Gas Leak Test Device.

7.17 Reconnect the 15 mm connector from the absorber system to the FRESHGAS OUTLET.

NOTE:

If the vaporizer O-rings appear intact and undamaged but the fresh gas system leaks, do not use the anesthesia machine. Contact an authorized North American Dräger Technical Service Center Representative.

## INSTALLATION PROCEDURE (continued)

WARNING:

Do not inhale anesthetic vapors while filling the vaporizer. Uncontrolled inhalation of anesthetic vapors is injurious to health.

WARNING:

Do not use a vaporizer that has been inadvertently filled with the wrong anesthetic. Drain the vaporizer and return it to the North American Dräger Technical Service Department.

Before filling a vaporizer, note the expiration date of the anesthetic agent. Do not use anesthetics beyond their date of expiration.

8. Ensure that the vaporizer handwheel is set to the Zero position and the button engages in the locked position.

**Open Funnel Fill System:**

9. Make sure that the filling spout is clean. To remove dust or other particles, use a clean, dry paper towel. Do not use water or other liquid cleaning solutions.

## INSTALLATION PROCEDURE (continued)

10. Make sure that the drain valve is closed. See Figure 3.

11. Open the inlet valve by turning it approximately three turns counter-clockwise.

WARNING:
Verify that the correct anesthetic agent will be used in the vaporizer.

12. Pour the anesthetic agent into the funnel and observe the liquid level in the sight glass. Fill the vaporizer to the MAX mark, and close the inlet valve.

NOTE:
The capacity of the vaporizer is approximately 200 cc with a dry wick, and approximately 140 cc with a wet wick.

13. After filling, check the level in the sight glass. The level must not exceed the MAX mark.

If the vaporizer is inadvertently overfilled, place an empty anesthetic-specific bottle under the drain hole of the filling spout and open the drain valve several turns (do not unscrew the valve completely).

Close the drain valve when the liquid level is correct.

Close and mark the bottle to indicate that it contains a previously used anesthetic agent.

14. Proceed to the VAPOR CONCENTRATION TEST.

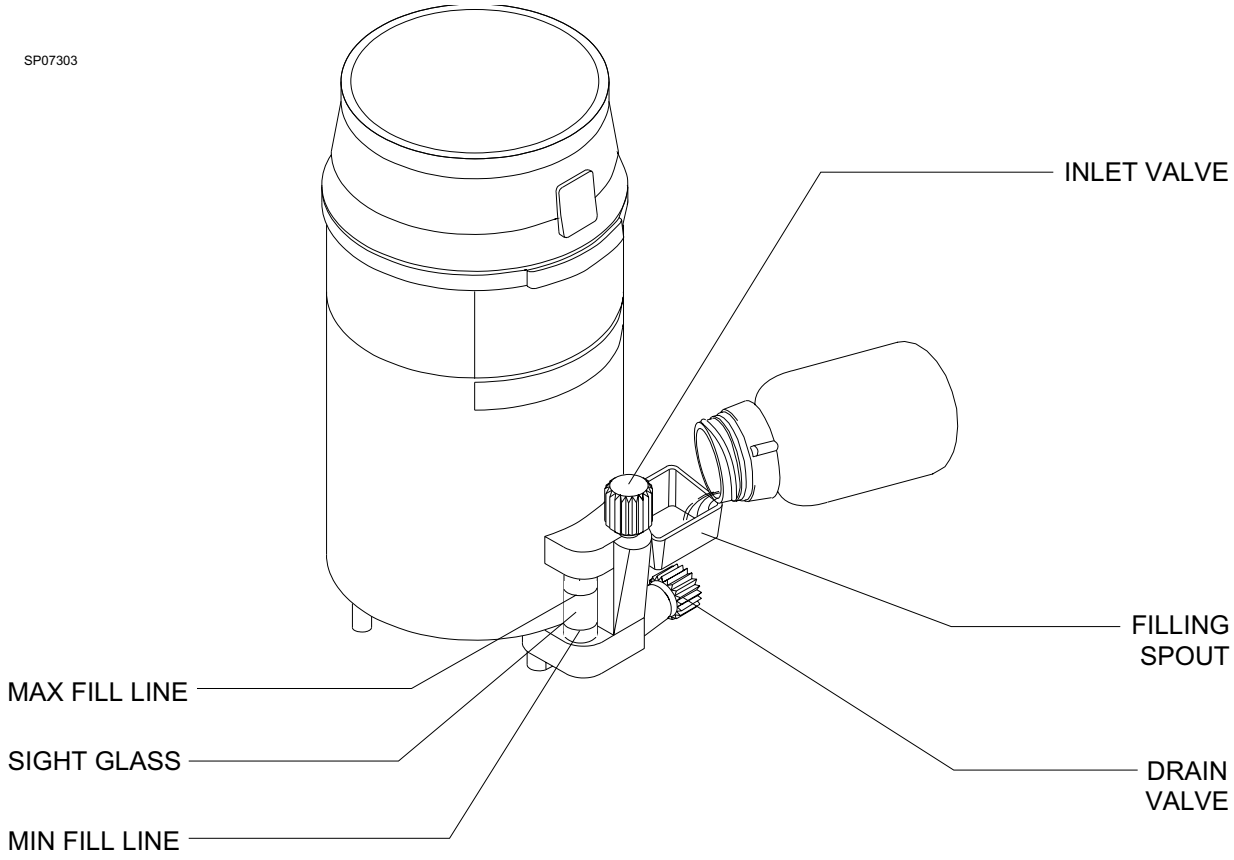


**Figure 3: VAPORIZER WITH OPEN FUNNEL SPOUT FILLING SYSTEM**

## INSTALLATION PROCEDURE (continued)

**Key Index Fill System:**

9. Remove the cap and seal from the anesthetic agent bottle. Verify that the sealing edge of the bottle is not chipped or damaged.

10. Attach the keyed bottle adapter to the keyed collar on the bottle. Screw the parts together tightly to form an airtight seal.

11. Turn the filler port lock screw counter-clockwise and remove the filler plug from the filler port. See Figure 4.

12. Insert the keyed adapter into the filler port of the vaporizer so that the two holes in the adapter face the Teflon seal surface of the filler port. Bend the filler tube so that the liquid level in the bottle is below the filler port. Adjust the plastic tubing to avoid kinks.

13. Turn the filler port screw clockwise to hold the adapter against the Teflon seal.

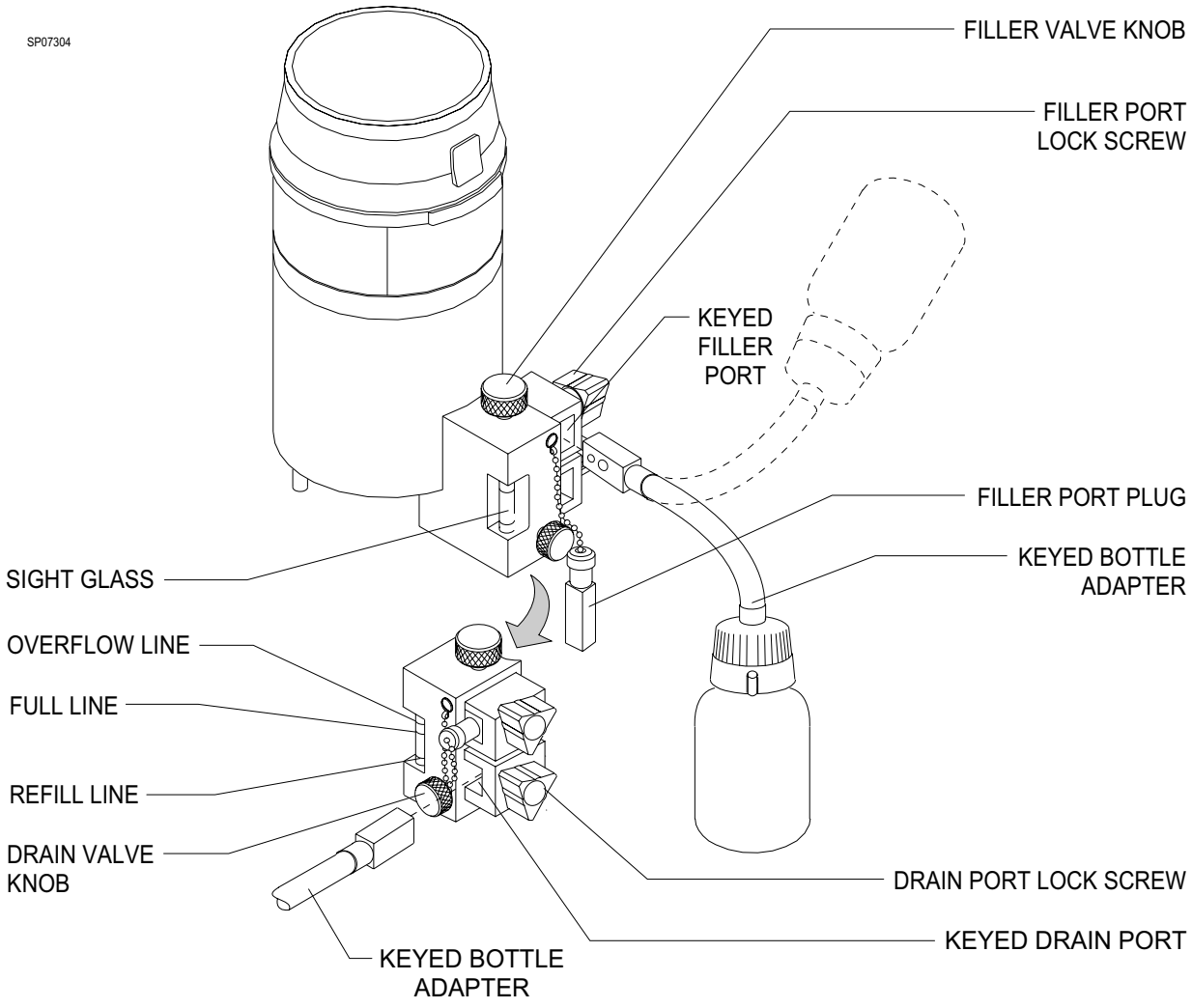


**Figure 4: VAPORIZER WITH KEY INDEX FILLING SYSTEM**

## INSTALLATION PROCEDURE (continued)

14. Open the filler valve by turning the knob counter-clockwise approximately three turns.

15. Lift the bottle above the filler port level, avoiding kinks in the plastic tube. The liquid should begin flowing within 10 seconds after raising the bottle. If liquid does not begin to flow within 10 seconds, move the bottle below filler port level and raise it above the filler port again. (This allows any air trapped in the tubing to escape.) Repeat as necessary to start the flow.

NOTE:
The capacity of the vaporizer is approximately 200 cc with a dry wick, and approximately 140 cc with a wet wick.

16. Watch the sight glass while the vaporizer is filling, and close the filler valve when the liquid level reaches the lower of the two marks at the upper end of the sight glass. The lower mark is the FULL line; the upper mark is the OVERFLOW line. Do not lower the bottle before closing the filler valve as this may cause agent to be siphoned from the vaporizer back into the bottle.

17. Remove the adapter from the filler port.

18. Allow excess liquid to drain from the filler port.

19. After filling, reinsert the filler plug into the filler (upper) port and tighten the filler port lock screw.

20. Check the level at the sight glass. When the vaporizer is in an upright position, the level must not exceed the FULL line.

    If the vaporizer is inadvertently overfilled, attach the keyed bottle adapter to an empty bottle, and insert the bottle adapter into the drain port of the vaporizer. Turn the drain port lock screw clockwise to hold the adapter against the Teflon seal.

    Hold the bottle below drain port level. Open the drain valve by turning the knob counter-clockwise and allow the liquid to drain into the bottle until the liquid level is correct.

    Close the drain valve and remove the adapter from the drain port.

    Close and mark the bottle to indicate that it contains previously used anesthetic agent.

21. Proceed to the VAPOR CONCENTRATION TEST.

## VAPOR CONCENTRATION TEST

NOTE:

North American Dräger recommends the vapor concentration test to be performed at six month intervals.

NOTE:

The vaporizer must be operated at room temperature (22 ± 2°C). If the vaporizer or the anesthetic agent was stored at another temperature, allow warm-up time of at least six minutes for each degree above or below 22 ± 2°C for the vaporizer; two to three hours for the anesthetic agent before proceeding with the test.

1. Ensure that all vaporizer handwheels are set to Zero.
2. Calibrate a Riken gas analyzer Model 18H or equivalent according to the manufacturer's instructions.
3. Activate the waste gas elimination system.
4. Connect the gas analyzer between the fresh gas outlet and the fresh gas hose of the anesthesia machine.
5. Open the APL valve by turning it fully counter-clockwise.
6. Attach a 12 inch, 22 mm hose between the inspiratory and expiratory valves.
7. Attach a breathing bag to the swivel bag mount connector, and set the Man/Auto selector valve to the BAG position.
8. Turn the System Power switch to ON and open an $O_2$ cylinder valve.
9. Set the oxygen flow rate to 10 l/min. to flush the system of residual gases.
10. Reduce the oxygen flow rate to 4 l/min.
11. Carefully turn the vaporizer handwheel to 1.0% volume concentration and wait five minutes for the vapor concentration to stabilize.
12. Record the value indicated* on the Riken gas analyzer and verify that it is within the range shown in the table below.
13. Carefully turn the vaporizer handwheel to 2.5% volume concentration and wait five minutes for the vapor concentration to stabilize.
14. Record the value indicated* on the Riken gas analyzer and verify that it is within the range shown in the table below.
15. Carefully turn the vaporizer handwheel to 4.0% volume concentration and wait five minutes for the vapor concentration to stabilize.
16. Record the value indicated* on the Riken gas analyzer and verify that it is within the range shown in the table below.

NOTE:

If the anesthesia machine is equipped with a multigas monitor, or is interfaced with a Vitalert 3000 series monitor, refer to the appropriate Operator's Instruction Manual for the making the agent monitor settings.

## VAPOR CONCENTRATION TEST (continued)

NOTE:

If the anesthesia machine is equipped with a multigas monitor, it may show a different reading than the Riken gas analyzer because of the tolerance of the multigas monitor. Verify that the displayed concentration is within the sum of tolerances of the vaporizer, the Riken gas analyzer and the multigas monitor.

17. Turn the vaporizer handwheel to Zero.

18. Close the oxygen flow control valve.

19. If the machine has not received a Periodic Manufacturer's Service (PMS) within the last three months, NAD recommends that a complete PMS procedure be performed at this time.

* The Riken gas analyzer Model 18H is calibrated for Halothane, and the Riken gas analyzer Model 1802D is calibrated for Desflurane. When testing vaporizers containing other agents, the readings must be multiplied by the conversion factors shown in the table to obtain the correct values. Be sure to use the conversion factors that apply to the gas analyzer you are using.

The values shown in the table take into account the combined tolerance of the vaporizer, gas analyzer, and the effect of oxygen as a carrier gas.

| ANESTHETIC AGENT | VAPORIZER SETTINGS AND ALLOWABLE RANGES | | | CONVERSION FACTORS | |
|---|---|---|---|---|---|
| | 1% | 2.5% | 4% | Riken Model 18H | Riken Model 1802D |
| Halothane | 0.92 to 1.28 | 2.30 to 3.20 | 3.58 to 5.02 | x 1.0 | x 0.74 |
| Enflurane | 0.87 to 1.33 | 2.175 to 3.325 | 3.38 to 5.22 | x 1.08 | x 0.80 |
| Isoflurane | 0.92 to 1.28 | 2.30 to 3.20 | 3.58 to 5.02 | x 1.05 | x 0.78 |
| Sevoflurane | 0.87 to 1.33 | 2.175 to 3.325 | 3.38 to 5.22 | x 1.09 | x 0.81 |

## HALOTHANE VAPORIZER SOIL TEST

NOTE: North American Dräger recommends this test to be performed only on Halothane vaporizers without serial numbers (on the body of the vaporizer) beginning with a plus (+). If required, this test shall be performed on an annual basis.

NOTE: The vaporizer does not have to be drained in order to complete this procedure.

NOTE: Room temperature must be between 15°C and 25°C when performing this procedure.

1. Turn the System Power switch on the anesthesia machine to STANDBY.

2. Turn the Halothane vaporizer handwheel to the OFF position.

**WARNING: DO NOT tilt the vaporizer more than 45° at any time.**

3. Remove the Halothane vaporizer from the anesthesia machine, and install a vapor block cover assembly (P/N 4104530) in its place.

4. Install the vapor test block onto the vaporizer as shown in Figure 1 using two 4 x 30 metric screws (P/N HW01072) and two O-rings (P/N 2121929).

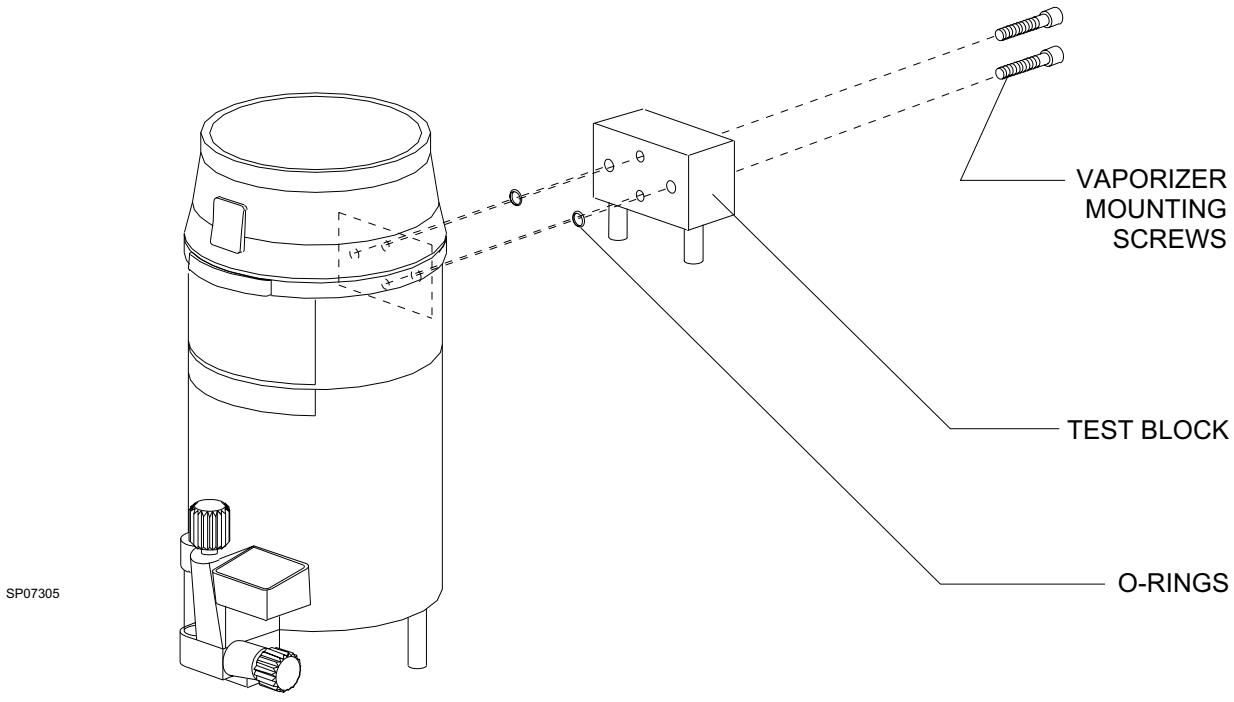


**Figure 1: VAPORIZER TEST BLOCK MOUNTING**

## HALOTHANE VAPORIZER SOIL TEST (continued)

5. Connect the vaporizer to the dosage tank as shown in Figure 2, and connect the dosage tank to the fresh gas outlet on the machine. DO NOT install the detector tube at this time.

6. Break off the narrow end of the ampule containing the test solution.

7. Remove the rubber plug from the dosage tank and pour the test solution into the tank.

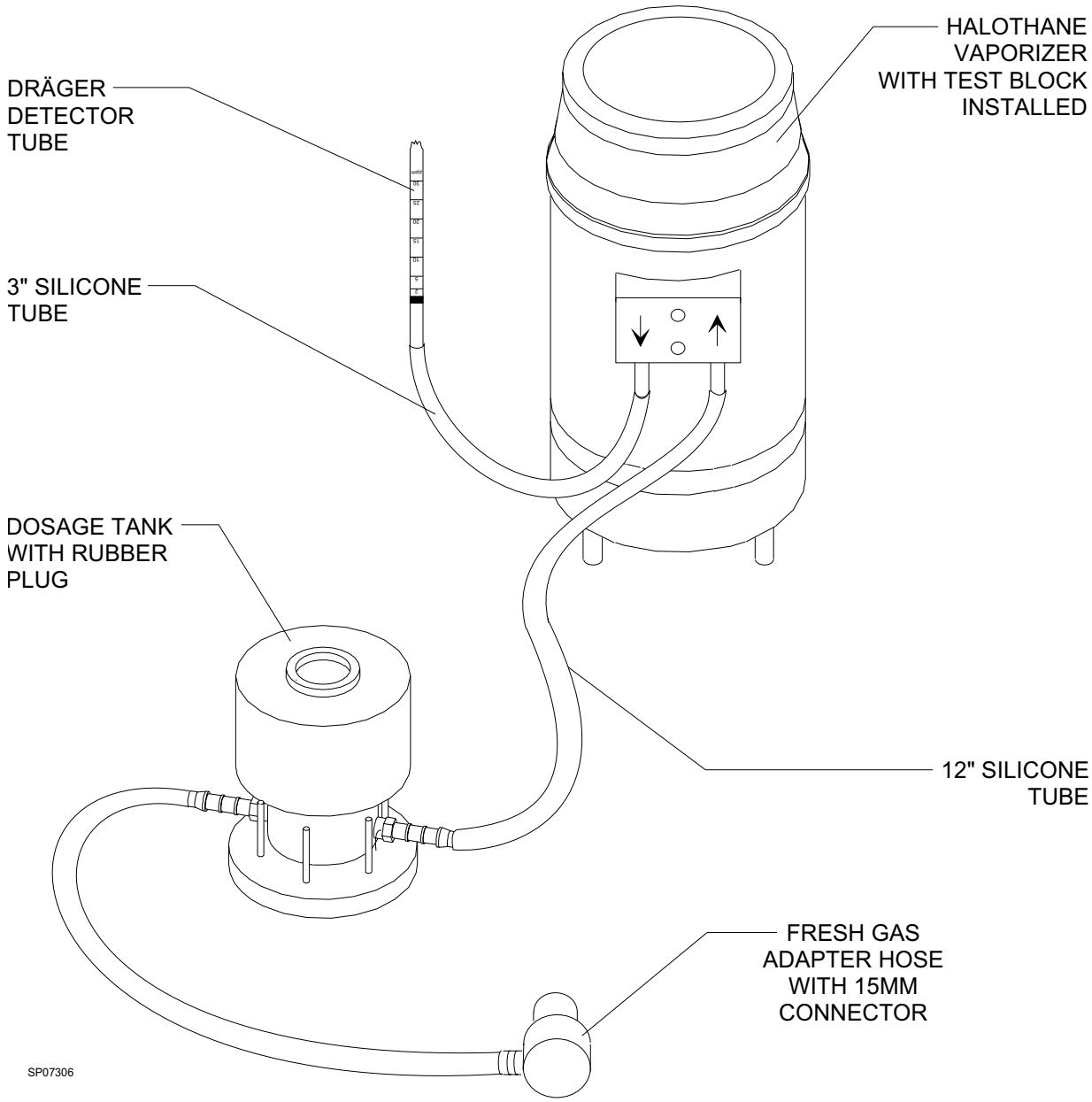
HALOTHANE VAPORIZER WITH TEST BLOCK INSTALLED
DRÄGER DETECTOR TUBE
3" SILICONE TUBE
DOSAGE TANK WITH RUBBER PLUG
12" SILICONE TUBE
FRESH GAS ADAPTER HOSE WITH 15MM CONNECTOR
SP07306

**Figure 2: VAPORIZER TEST CONNECTIONS**

## HALOTHANE VAPORIZER SOIL TEST (continued)

8. Replace the rubber plug in the dosage tank, and vent the tank by briefly pulling the plug away from the side of the tank to relieve any pressure.

9. Separate the dosage tank from gassing adapter and inspect the diaphragm for any leaks. Replace the diaphragm if any leaks are present. Install the dosage tank into the gassing adapter and repeat Step #8.

10. Turn the System Power switch to ON, and set the oxygen (or air) flow to 200 ml/min. Ensure that all other gases are turned off and that the Halothane vaporizer handwheel is set to Zero.

11. Score both ends of a detector tube by rotating them in hole #1 of the tube snapper. Then insert each end in hole #2 and press down firmly until the end of the tube breaks off.

12. Connect the detector tube to the vaporizer output as shown in Figure 2, with the black band on the tube closest to the vaporizer.

NOTE: When the detector tube is connected, the gas flow rate will drop slightly. DO NOT readjust the flow.

**Time Measurement:**

13. When the blue indicator in the detector tube reaches the 2 ppm mark (see Figure 3), start the digital timer.

14. When the blue indicator in the Detector Tube reaches the 10 ppm mark, stop the timer and record the elapsed time ($\Delta T_1$).

a. If $\Delta T_1$ is between 15 and 60 seconds, proceed to Step 15.

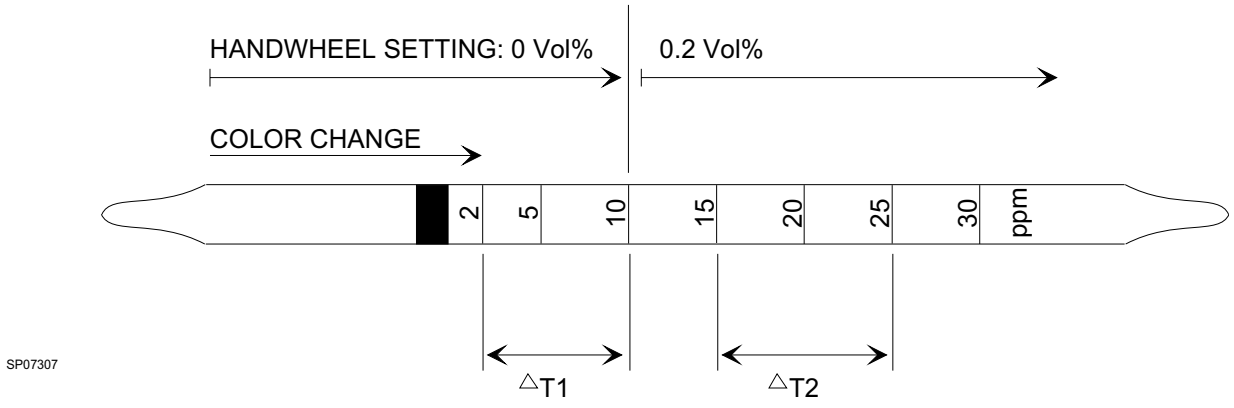


**Figure 3: DRÄGER DETECTOR TUBE**

## HALOTHANE VAPORIZER SOIL TEST (continued)

b. If $\Delta T_1$ is less than 15 seconds, terminate the measurement immediately. Examine the container beneath the dosage tank for traces of liquid. If liquid is found, replace the diaphragm by removing the four hex screws from the dosage tank and installing a new diaphragm.

Following diaphragm replacement, disconnect the test set-up and blow out the vaporizer and the dosage tank with a flow of 4 l/min. of gas for three minutes.

c. If $\Delta T_1$ is greater than 60 seconds, terminate the measurement and verify that the test setup is correct. If the test setup is correct, renew the test solution and repeat the test.

d. If $\Delta T_1$ is still greater than 60 seconds, then connect the detector tube directly to the output of the dosage tank and check whether color change occurs within 60 seconds. If the color change takes place, then the test setup is correct and the vaporizer is considered Soil Degree 1. Proceed to Step 17.

15. Turn the Halothane vaporizer handwheel to 0.2 vol %. Reset the timer when the blue indicator reaches the 15 ppm mark.

16. The blue indicator shall reach the 25 ppm mark in a ($\Delta T_2$) of less than or equal to 120 seconds.

a. If $\Delta T_2$ is less than or equal to 120 seconds, the Halothane vaporizer is suitable for service and can be reinstalled on the machine.

b. If $\Delta T_2$ is greater than 120 seconds, the vaporizer is considered Soil Degree 1. Proceed to Step 17.

**For Soil Degree 1:**

17. Place a "CAUTION: DO NOT USE" sticker (P/N 4114327) on the vaporizer.

18. Ensure that a vapor block cover assembly is secured to the machine.

19. Return the soiled vaporizer to the NAD Technical Service Department.

20. Exchange vaporizers are available from the NAD Technical Service Department under the following part numbers:

4104464 Exchange Halothane Vapor 19.1 (Funnel Fill)

4106039 Exchange Halothane Vapor 19.1 (Pin Index Safety System)

21. After an Exchange vaporizer has been installed, record its serial number on the Vapor Concentration Verification section of the Vigilance Audit® report.

22. Test the Exchange vaporizer in accordance with the Vapor Concentration Test Procedure (see Page 7). Record the results on the Vapor Concentration Verification section of the Vigilance Audit® report.

## HALOTHANE VAPORIZER SOIL TEST (continued)

23. Perform a low pressure leak test.

24. On the Vapor Concentration Verification section of the report, make the following entry for the Halothane vapor under "Comments":

    "Returned to NAD" and add the appropriate serial number.

## EQUIPMENT REQUIRED

1. Vaporizer Testing Kit including: (P/N S010149)

   - Connector Asm., 15mm Male (P/N 4102054)
   - Vapor Test Block (P/N 4103531)
   - Hose, Rubber (P/N 4103982)
   - Membranes (set of 5) (P/N S010139)
   - 3" Silicone Rubber Tube (P/N S010141)
   - 12" Silicone Rubber Tube (P/N S010142)
   - Rubber Plug (P/N S010143)
   - Tube Snapper w/glass retainer (P/N S010144)
   - Support (P/N S010146)
   - Adapter, Gas (P/N S010147)
   - Dosage Tank (P/N S010148)
   - Vaporizer 19 and 19.1 Service Procedures (P/N SP00073)

2. Digital Timer

3. Vapor Block Cover Assembly (P/N 4104530)

4. Detector Tubes, (set of 10) (P/N S010145)

5. Solution, Test (set of 5) (P/N S010140)

## TRANSPORT OF VAPORIZER

WARNING: The following procedure must be performed in a well ventilated area with no unauthorized personnel present.

1. Drain the vaporizer completely.
2. Direct fresh gas flow to the scavenger.
3. Activate the scavenger.
4. Turn the vaporizer handwheel to the maximum concentration setting.
5. Set the oxygen flow to 10 l/min. for at least twenty minutes.
6. Turn the vaporizer handwheel to Zero.
7. Turn the oxygen flow OFF.
8. Remove the vaporizer from its mount.
9. Package the vaporizer carefully for shipment.

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